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ABSTRACT

This resource catalog is intended for the use of teachers and school administrators who wish to implement a program of mathematics instruction based on identification of student performance needs. The characteristics, objectives, and planning of such a program are discussed. Resource products are divided into the categories of teacher education, comprehensive math objectives, and math products that meet specific objectives. Program focus, grade level, and components are described. Ordering information is provided. (JD)

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MATH INSTRUCTION
BASED ON IDENTIFICATION
OF STUDENT PERFORMANCE NEEDS

An Educational Products Information Booklet

Developed by:

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Florida State University
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FLORIDA LINKAGE SYSTEM PROJECT
Office of Educational Dissemination/Diffusion
Florida Department of Education

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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OTHER DESCRIPTORS OF THE CONTENT

Mastery Learning

Individualized Instruction

Diagnostic/Prescriptive Instruction

Continuous Progress Learning

Performance-based Instruction

Competency-based Instruction

Ad-hoc Grouping

Management by Objective

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INTRODUCTION

On the following pages, you will be introduced to educational products which base math instruction upon the identification of student performance needs. All of the products listed have demonstrated their effectiveness in field-testing. This means that if you implement the program as specified, you can expect that your students will achieve in a manner similar to field-test students.

If you are receiving this package as a response to a stated problem, you will note that some product names have been checked. These products appear to match the situation you have described. Descriptions of checked products are included in this information packet. If you wish, you may request information on products not checked.

If you have requested general information on math instruction based on the identification of student performance needs, you will receive only this packet which lists names and descriptions of such products. You may receive more specific information on any of the products listed by detaching the form on the last page, checking the name of the products for which you wish to receive more information and sending it to FREE, Office of Educational Dissemination/Diffusion. Florida Department of Education, The Knott Building, Tallahassee, Florida, 32304. The telephone number you may call collect is (904) 487-1078.

Be sure to state the name of the product for which you wish to receive more information, and the name of the packet in which it is listed. (The name of this packet is MATH INSTRUCTION BASED ON THE IDENTIFICATION OF STUDENT PERFORMANCE NEEDS).

MATH INSTRUCTION

BASED ON THE IDENTIFICATION OF

STUDENT PERFORMANCE NEEDS

"Math instruction based on the identification of student performance needs" is a strategy that has been assigned a number of labels: mastery learning, individualized learning, diagnostic/prescriptive instruction, continuous progress learning, performance-based instruction, etc. The critical elements of a program that bases instruction on student needs are as follows:

1. The program goals are clearly stated and analyzed into tasks that a student "must be able to do" to reach the goal.

2. Students are initially tested to see which tasks they can do and which they must learn to do.

3. For each task that a student is initially unable to do, a structured time for learning the task must be provided.

4. When the student completes the process of learning all of the tasks, a "mastery" test is given to see if the student can accomplish the program goal.

It is easy to see why an instructional model with such elements is called "instruction based on the identification of student performance needs." When students are initially tested (step 2), their "needs" are identified. The label "individualized" also fits because each student's individual profile of needs is identified. Some instructional programs are designed so that a student receives instruction at an individual pace, while other programs suggest that ad-hoc grouping be used. (In ad-hoc grouping, the groups change to accommodate student progress so that all the students in a

group at a given point in time have the same identified needs.) The label "continuous progress" is descriptive because students work on tasks which enable continuous progress to the program goal. They are not asked to practice tasks already mastered while they wait for others to "catch-up" with them. They keep moving ahead to new objectives each time they have mastered the previous one. Since each task must be mastered before the student is considered capable of performing the goal, it is easy to see why such instruction is called "mastery learning." The instruction is "performance-based" because the objectives are described in words which report the performance the student should be able to do as a result of the instruction.

EFFECTIVENESS OF INSTRUCTION THAT IS BASED ON STUDENT NEEDS

Increased achievement in basic skills has been shown to be related to:

1) Clearly-stated objectives (Holzman and Boes, 1973; Rosenshine, 1976; Gow, 1977).

2) The use of objectives testing to place students in instruction (Glaser, 1965; Gow, 1977; Kamm, 1978).

3) Well-structured instructional programs which match the objectives (Rosenshine, 1976; Evertson and Brophy, 1973).

4) Classroom organization and instructional practice which permits students to use class time for tasks (Berliner and Rosenshine, 1977).

5) Teachers knowledgable in diagnostic/prescriptive techniques and direct teaching strategies (Berliner and Rosenshine, 1977; Medley, 1977; Kamm, 1978).

In a cost-effectiveness study of ninety-two programs, it was found that successful programs had a greater degree of program organization such as objectives testing, instruction based on identification of needs, and record-keeping of student progress (Gow, 1977).

CHARACTERISTICS OF AN EFFECTIVE PROGRAM FOR MATH INSTRUCTION BASED ON THE IDENTIFICATION OF STUDENT PERFORMANCE NEEDS.

1. The program has stated objectives which are derived either from the results of research or by systematic investigation of the content area.

2. The objectives are stated in terms that describe what the student is to do. (The objectives are measurable).

3. The objectives are sequenced or grouped logically so that the student learns prerequisite skills and knowledge before proceeding to a more complex task.

4. The list of objectives is an optimal outline, rather than a collection of "nice-to-know-or-do" statements that put an unnecessary burden on testing and instructional time.

5. The tasks demanded by the test items match the student performances named in the objectives.

6. Information from the initial testing is used to identify which instruction a student needs and which the student can bypass.

7. The instruction is designed so that the student engages in tasks appropriate for the learning of the objective.

8. When a student masters one objective, that student passes immediately to the next objective in the sequence without delay.

9. The student is aware of the objectives and the progress that he/she is making.

10. The materials are designed so that teachers or students do not waste excessive time in in mechanics of testing, grouping for instruction, finding materials, etc.

PLANNING FOR THE ADOPTION OF INSTRUCTION BASED ON THE IDENTIFICATION OF STUDENT PERFORMANCE NEEDS

A school considering the implementation of instruction based on identified student needs will be successful if it answers the following questions in an early stage of planning:

1. Are the objectives of the program stated clearly? Do the stated objectives fit the school's goal?

2. Do the tasks demanded by the test items match the stated student objectives?

3. Are teachers familiar with the instructional methods required by diagnosing, prescribing, and testing or should extensive staff development be planned?

4. Do the program materials include:

   a. placement testing (pre-test, diagnostic test, entry test)?

   b. suggestions for activities or actual materials that provide students with practice?

c. a mastery test (post-test, criterion test, exit test)?

d. a record-keeping system that provides information on the individual student? the class profile?

e. procedures or materials for informing parents of the program's goals and of their child's progress?

5. Has the school or school district provided a support system which functions during the implementation phase of the program so that problems which arise may be answered immediately?

MATH PROGRAMS BASED ON IDENTIFICATION OF STUDENT PERFORMANCE NEEDS

The math programs listed here have been shown to be effective in field testing. A school that implements a validated program can expect gains similar to those made at demonstration schools.

Products based on the identification of student performance needs for math have been divided into the following categories: Teacher Education, Products with Comprehensive Math Objectives, and Math Products which Meet Specific Objectives.

The remainder of this report will be devoted to describing these categories--in this order--and the math programs which fall in each of them.

I. Teacher Education

The programs listed here focus upon the development of teacher skills in organizing and managing classrooms where instruction is based on student needs.

They also teach techniques for diagnosing student needs and providing prescriptive instruction.

If your school has already adopted an objective testing/management system and you are searching for validated materials which match particular objectives, please request a search for such materials from FREE.

ARIZONA CONSORTIUM FOR INDIVIDUALIZED LEARNING (ACIL)

Target Audience: Teachers, grades K-8

Description: ACIL was designed to support teachers and principals during the transition from traditional to a diagnostic/prescriptive instructional system. The teacher in-service training uses a "how-to" approach, which is paralleled by a principal in-service training emphasizing the development and use of instructional leadership skills. The Utah System Approach to Individualized Learning (U-SAIL) is used as the diagnostic system for ACIL.

INDIVIDUALLY GUIDED EDUCATION (IGE)

Target Audience: Schools or school districts who wish to develop individually guided instruction.

Description: IGE personnel will work with local school personnel in implementing an instructional program based on the identification of student needs. Of particular interest is the Instructional Programming Model (IPM) which described a systematic approach to individualizing any content area. The Developmental Math Program (DMP) is an instructional component of the IGE System.

MODEL CLASSROOMS

Target Audience: Teachers, Grades 1-6

Description: A six-day workshop is conducted with teachers during the summer. During this time teachers learn to administer placement tests, use class profile sheets, prepare presentation sheets, and conference with students. Teachers also select math skills for grades K-6 and develop a keying system for relevant classroom materials. When school begins, teachers operate their programs for two and a half hours daily. Student progress is assessed weekly and students' monitor their own progress.

LEARNCYCLE: RESPONSIVE TEACHING

Target Audience: Teachers who need skills for teaching high risk students.

Description: Responsive teaching comprises a variety of reinforcement-based teaching techniques including precision teaching, contingency management and token economics. During the training, teachers get to role play and observe so that they are able to generate their own unique programs. The training also shows teachers how to monitor, evaluate, and revise their programs in accordance with changing student needs and in line with recent accountability mandates. School districts may implement LEARNCYCLE by sending an individual to receive training that is then shared with individual teachers who wish to adopt the program. LEARNCYCLE manuals are provided at no cost.

FAST: Functional Analysis Training

Target Audience: Teachers of students of all abilities Grades K-6.

Description: A teacher receiving the instruction learns how to place students and evaluate their progress, how to analyze student tasks, how to organize the classroom into learning centers for diagnostic/ prescriptive teaching, how to find or develop prescrip-

tive instruction, how to utilize support personnel, and how to involve parents in classroom activities. Materials are provided in a kit so the teacher has in the classroom a resource for reviewing skills.

II. Comprehensive Math Objectives

The primary components of programs listed in this section are a set of math objectives stretching over several grade levels, a hierachical sequencing of the objectives which places mastering of prerequisite skills before introduction of more complex skills, and a management system for diagnosing abilities and measuring mastery.

KEYMATH

Target Audience: Grades K-8

Description: KEYMATH is a diagnostic skills test, not a full mathematics program. In administering the test, the teacher interacts with the student in a one-to-one setting. The teacher directs the student and monitors his/her responses during the 30 minute session. Test directions instruct teachers on how to question students to elicit their knowledge(or lack of knowledge). Teachers may use the knowledge gained during diagnosis to prescribe needed instruction. The reusable easel-kit test book and test manual costs only $25.00.

BREVARD COUNTY LEARNING ACTIVITIES MATH PACKAGE (B.Co LAMP)

Target Audience: Grades K-6

Description: Students are diagnosed and then visit learning centers to receive prescriptive instruction. Instruction is sequenced so that the student is introduced to the concept by use of concrete manipulatives.

Students repeat practices using semi-concrete materials such as pictures, and then perform using symbolic materials typically found in a basal text. Thus the B. Co·Lamp provides a management system for a basal text series. Teacher training in instructional strategies and materials workshops for making learning center activities are both features that insure the success of the B. Co.Lamp program in an adopting school.

CONCEPTUALLY ORIENTED MATHEMATICS PROGRAM (COMP)

Target Audience: Grades 1-8

Description: COMP is a management system that provides a list of sequential skills to be mastered in each of the basic skill areas. Students are initially assessed and grouped accordingly. The program utilizes cooperative planning and teaching so that a teacher has no more than two instructional groups. Teachers are encouraged to be creative in their teaching and to adapt to the learning styles of their students.

STAMM: SYSTEMATIC TEACHING AND MEASURING MATHEMATICS

Target Audience: Grades K-12

Description: STAMM provides a continuous progress program for the entire school experience of all students. Alternative courses at the high school level are provided. Complete records on the progress of each student are kept by the school. Students are tested for entry level skills, then receive appropriate instruction, and are tested for mastery. STAMM encourages teachers to maintain an instructional style suited to their pupil's needs. Materials can come from several sources: basal texts, STAMM, or teacher-made materials, and are integrated so that students work to master the objectives.

UTAH SYSTEMS APPROACH TO INDIVIDUALIZED LEARNING (U-SAIL)

Target Audience: Grades K-9

Description: Students' math ability levels are determined by testing. Teachers plan prescriptive instruction using the U-SAIL activity sheets and worksheets. Material from popular basal-series and supplemental materials are also keyed to each U-SAIL objective. The teacher teaches concepts, and monitors and conferences with each student as needed.

A SYSTEMS APPROACH TO INDIVIDUALIZED INSTRUCTION (SAII)

Target Audience: Grades 1-8

Description: SAII provides the teacher with a hierarchical list of skills for math, instructional objectives for each skill, and necessary pre- and post-tests. Program Management Units support each set of objectives and provide learning activities and alternative routes of instruction. Classroom organization may vary from self-contained classrooms to unit arrangements with differentiated staffing.

INDIVIDUALIZED LEARNING FOR ADULTS

Target Audience: Adult Learners

Description: This self-directed learning program has a math continuum consisting of 109 performance objectives organized into a hierarchical sequence. Each ILA performance objective is accompanied by an self-instructional booklet; and includes skills tests which can be self-corrected. Entrance tests, prescription booklets, a teacher's manual and a record keeping system are components of the program.

DEVELOPING MATHEMATICAL PROCESSES (DMP)

Target Audience: Grades K-6

Description: Stated objectives, diagnostic placement tests, record keeping, and ongoing student assessment form the structure of DMP. It's uniqueness lies in the activity-oriented instructional method and the real world applications that students make with the math skills. DMP is a complete elementary math program, and requires no additional text or materials. The program is the mathematics component of Individually Guided Education (IGE).

IPI MATH: INDIVIDUALLY PRESCRIBED MATHEMATICS

Target Audience: Grades K-6

Description: The ten learning areas in IPI are numeration/place value, addition/subtraction, multiplication/division, fractions, money, time, systems of measurement, geometry, and applications. Placement tests are designed to measure the level of mastery for each learning area. Pre-tests are given for a specific objective. The teacher plans the prescription for each student. Self instructional skill booklets teach the student one instructional objective. Embedded in each skill booklet are tests to measure the child's interium progress. A post-test is given to determine if mastery occurs. The IPI teacher instructs small groups evaluates diagnostic tests, and develops pupil prescriptions.

DESIGN FOR MATH

Target Audience: Grades K-6

Description: DESIGN FOR MATH is an objective-based math management system. The instructional system directs teachers through three experience levels until they are competent in abstract computation: 1) real situations

with concrete materials, 2) simulated situations with pictorial materials, and 3) abstract situations with paper and pencil computations and new situations for application. Besides typical math areas, DM includes geometry, measurements, money, time, and graphing. Program components are: placement tests, pre- and post-test, a teacher's resource file for prescriptive materials, and a record keeping system. DM works as a management system for typical basal-text materials.

PVS: PROFICIENCY VERIFICATION SYSTEM

Target Audience: Grades 1-6

Description: PVS is a testing system that can be tailored to fit with the basal-text. PVS includes an initial skills inventory used at the beginning of the year, a mid-year inventory designed as a report to the administration and an extended survey of math skills designed to provide an indepth view of math skills that cannot be achieved with typical multiple choice paper-pencil format testing. PVS is available in a Spanish edition. The tests are designed for machine grading and printed summaries of the individual and the class are available to the teacher so that appropriate instruction can be planned.

INDIVIDUALIZED MATHEMATICS SYSTEM (IMS)

Target Audience: Grades 1-6

Description: The basic component of IMS is not the traditional textbook, but a series of 4,000 reusable long-lasting laminated pages, except for Level 1 Skills booklet. EPIE reviewers note the attractive page arrangement decorated with line drawings. The students keep track of their own progress. Pre- and post-test are used to determine student mastery.

III. Math Products Which Meet Specific Objectives

The following programs have a more limited scope or are used as supplemental programs.

PROJECT R-3 READINESS, RELEVANCY AND REINFORCEMENT

Target Audience: Students of all abilities, grades 7-9

Description: Project R-3 has an identified hierachy of skills, stated objectives, diagnostic placement tests, on-going student assessment, and a record keeping system. The reinforcement of skills learning by gaming and simulation make Project R-3 unique. In the simulations both math and reading are practiced in a situation in which students are intensively involved.

PRE-ALGEBRA DEVELOPMENT CENTERS

Target Audience: Grades 7-8, or remedial

Description: Four activities are designed for students: (1) diagnosis, (2) classroom for direct instruction, (3) self-directed laboratory, and (4) self-directed reading and problem solving. The concepts taught by direct instruction are reinforced by game-like activities in the lab and by application in self-directed problem-solving. Students are diagnosed for placement and assessed as they progress.

SRA DISTAR ARITHMETIC

Target Audience: Grades K-3

Description: Clear teacher instructions promote all of the steps of direct instruction used to introduce arithmetic concepts. Skills are reinforced in independent activity, in take-home worksheets and in review sessions directed by the teacher. A major focus of DISTAR ARITHMETIC is the application of skills in the solution of story problems. DISTAR features placement tests, pre- and post-tests, and record keeping.

DIAGNOSTIC PRESCRIPTIVE ARITHMETIC (DPA)

Target Audience: Grades 2-6, and Remedial

Description: DPA objectives are limited to counting, place value, addition, subtraction. The program succeeds because it emphasizes the use of hands-on materials and activities. One goal of DPA is to increase the student's rate of learning. A diagnostic test is used to identify the student's strengths and weaknesses, both in concepts and skills. Prescriptions are planned using the DPA teacher's manual. Over seventy-five activities are described for involving students in active learning. The teachers manual describes a variety of games and materials that teachers can make.

BILINGUAL CONTINUOUS PROGRESS MATHEMATICS (BCPM)

Target Audience: Grade 1. Spanish-speaking and English-speaking children

Description: Ninety-three objectives are arranged into the area of number, fractions, and time, at two levels of difficulty. Each area has diagnostic tests, games, instructional cassette tapes with corresponding booklets and mastery tests. The instructional mode is aural/visual, and the teacher may plan instruction which best fits the child.

PROJECT SMART: SUCCESS IN MATHEMATICS THROUGH AURAL READING TECHNIQUES.

Target Audience: Slow learners in basic math skills, grades 5-9

Description: Project SMART intends to help students overcome difficulties in mathematics which are related to poor reading skills. Prepared cassette tapes are used to individualize the aural presentation of text materials, so students proceed at their own pace. The curriculum is divided into 40 units of work ranging from number recognition to elementary algebra and geometry. Students are diagnosed, placed, and their progress tracked. Students use self-instructional booklets, worksheets, self-tests, and the tapes. Mastery tests are administered by the teacher when the student completes a unit.

PAEC/PALS BASIC MATH

Target Audience: Slow learners, mentally handicapped learners, grades 4 - adult.

Description: Sixty separately-titled math booklets in areas of basic skills: word problems, vocabulary and symbols, and consumer-related skills were developed by classroom teachers to supplement the regular math program. Each title deals with one major concept or skill and has a consumable student edition and a reusable teacher edition. Materials are available at production cost.

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MATH PROGRAMS BASED ON STUDENT NEEDS	GRADE LEVEL	PROGRAM COMPONENTS											START-UP COSTS PER PUPIL (approx)
		Objectives Stated	Diagnostic Testing	Continuous Progress	Prescription Keys	Materials Provided	Teacher-Made Prescription	Mastery Testing	Record-Keeping System	Teacher Training	Parental Involvement	Motivation	
Arizona Consortium for Individualized Learning (ACIL) (b)	K-8									X			$10.00/teacher
Individually Guided Education (IGE)	K-12									X		X	varied
Model Classrooms	1-6	X								X		X	varied
Learncycle	K-9			X				X	X	X		X	manuals provide free
FAST	K-6									X	X	X	$35/teacher
Keymath	K-8	X	X							X			$25/test kit
B.Co. LAMP (a)	K-6	X	X	X	X	X	X	X	X	X		X	$6.10
COMP (b)	1-8	X	X	X	X	X		X	X	X			$.85
STAMM (b)	K-12	X	X	X	X	X	X	X	X	X			$8.00
U-SAIL (b)	K-9	X	X	X	X	X		X	X	X			$8.00

a = Eligible For State Adopter Grant
b = Eligible For State Facilitator Support

MATH PROGRAMS BASED ON STUDENT NEEDS	GRADE LEVEL	PROGRAM COMPONENTS											START-UP COSTS PER PUPIL (approx)
		Objectives Stated	Diagnostic Testing	Continuous Progress	Prescription Keys	Materials Provided	Teacher-Made Prescription	Mastery Testing	Record-Keeping System	Teacher Training	Parental Involvement	Motivation	
SAII (b)	1-8	X	X			X		X	X	X			$4.65
Individualized Learning for Adults	Adult	X	X	X	X	X		X	X				$2.50
Developing Mathematical Processes	K-6	X	X	X		X		X	X	X		X	$7 to 14
IPI MATH	K-6	X	X	X		X		X	X	X			$5.50
Design for Math	K-6	X	X		X	X		X	X	X			$2.50
PVS for Math	1-6		X					X	X				$1.25
Individualized Math System	1-6					X		X	X	X			$7.00
Project R-3 (b)	7-9	X	X			X		X	X	X		X	varied
Pre-Algebra Development Centers (b)	7-8		X			X		X	X				$4.00 + Lab equipment
Diagnostic-Prescriptive Arithmetic (b)	2-6 R		X			X	X		X	X		X	$3.75

a = Eligible For State Adopter Grant
b = Eligible For State Facilitator Support

MATH PROGRAMS BASED ON STUDENT NEEDS	GRADE LEVEL	PROGRAM COMPONENTS											START-UP COSTS PER PUPIL (approx)
		Objectives Stated	Diagnostic Testing	Continuous Progress	Prescription Keys	Materials Provided	Teacher-Made Prescription	Mastery Testing	Record-Keeping System	Teacher Training	Parental Involvement	Motivation	
Bilingual Continuous Progress Math	1	X	X			X		X	X	X			$12.00
Project SMART (a)	5-9 R		X	X					X	X		X	$7.94
PAEC/PALS	4 A,R	X		X		X							At cost

a = Eligible For State Adopter Grant
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MATH INSTRUCTION
BASED ON THE IDENTIFICATION OF
STUDENT PERFORMANCE NEEDS

To receive more information, check the name of the selected product on this sheet. Detach, fold so that the address shows, and mail.

Teacher Education

_____ARIZONA CONSORTIUM FOR INDIVIDUALIZED LEARNING (ACIL)

_____INDIVIDUALLY GUIDED EDUCATION (IGE)

_____MODEL CLASSROOMS

_____LEARNCYCLE: RESPONSIVE TEACHING

_____FAST: Functional Analysis Training

Comprehensive Math Objectives

_____KEYMATH

_____BREVARD COUNTY LEARNING ACTIVITIES MATH PACKAGE

_____CONCEPTUALLY ORIENTED MATHEMATICS PROGRAM (COMP)

_____STAMM: SYSTEMATIC TEACHING AND MEASURING MATHEMATICS

_____UTAH SYSTEMS APPROACH TO INDIVIDUALIZED LEARNING (U-SAIL)

_____INDIVIDUALIZED LEARNING FOR ADULTS

_____IPI MATH: INDIVIDUALLY PRESCRIBED MATHEMATICS

_____DESIGN FOR MATH

_____A SYSTEMS APPROACH TO INDIVIDUALIZED INSTRUCTION (SAII)

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_____PVS: PROFICIENCY VERIFICATION SYSTEM

_____INDIVIDUALIZED MATHEMATICS SYSTEM (IMS)

Math Products Which Meet Specific Objectives

_____PROJECT R-3 READINESS, RELEVANCY, AND REINFORCEMENT

_____PRE-ALGEBRA DEVELOPMENT CENTERS

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